# On the Alignment and Possible Origin of Certain Ancient Sites in Mesoamerica

**Preprint** · April 2020

DOI: 10.13140/RG.2.2.12699.21286



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# On the Alignment and Possible Origin of Certain Ancient Sites in Mesoamerica

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## ABSTRACT

A study of ancient sites in Mexico and Central America finds that most are not aligned in any obvious astronomical direction, e.g., to north, or solstices or lunar standstills. While others have demonstrated some success in relating the alignments of structures at Mesoamerican sites to the surrounding landscape, important calendar dates, and certain constellations, this paper considers a different hypothesis – that the original builders aligned the sites to other locations that were points of reference at the time of construction. Among the 160 ancient locations examined in our study, we have found 64 sites/structures that point to four locations within 20° of the North Pole. These locations are correlated with Charles Hapgood's estimated locations of the geographic pole over the past 100,000 years. The angular distribution of our site alignments to past pole locations is consistent with orientation data collected by González-García and Šprajc. By their alignment to past poles, we hypothesize that these sites were first established by a previous (unknown) civilization that existed in this part of the world tens of thousands of years ago. Predating known history we evaluate our hypothesis in a mythological context and show that it supports an early version of the Mesoamerican legend of the Five Suns.

## 1. Introduction

There are thousands of ancient structures in Mexico and Central America. Based on measurements from hundreds of locations it evident that their alignment is clearly non-uniform, exhibiting concentrations in certain directions. That this occurs at places spread far apart in space and time suggests an astronomical explanation. One proposal is they are aligned in directions of sunrises and sunsets on particular dates related to the agricultural cycle and calendrical system (Aveni 1980).

González-García and Šprajc (2016) analyzed the orientations of 271 structures at 87 sites in the Mayan lowlands and found that the distribution of orientations was largely in the east-west direction referring to the Sun and the major extremes of Venus and the Moon. From an analysis of the distribution of sunrise and sunset dates corresponding to solar orientations, they hypothesize that these dates are multiples of 13 and 20 days and so the alignments may be related to the Mesoamerican 260-day calendar. It is apparent from the collected data that alignments in the cardinal directions, solstices, and lunar standstills are much less frequent than those in other directions (Figure 1). What is particularly interesting is the large concentration of unexplained orientations displaced 10° to 20° south of east. Astronomically this range of directions lies between the equinox and lunar and solar extremes.

The orientations of Greek temples were once thought to involve alignments to the sun and stars on feast days of deities (Hannah 2013). It has however become evident that there is no simple rule to explain the temple alignments (Hannah et al 2015). Boutsikas (2009) argues that the role of the sun was probably overestimated by archaeologists because so many Greek temples are aligned generally in east-west directions. The role of the sun in the alignment of Mesoamerican temples may be similarly overestimated. Rather than assuming that sites were aligned to solar events related to calendrical dates, we consider a different possibility.

It has been determined that numerous sites across the world appear to be aligned to previous locations of the geographic pole (Carlotto 2019a). Using a shifted pole alignment model, in two regional studies (Carlotto 2019b, 2020a) it is shown that almost one hundred sites in Greece, western Turkey, southern Italy, and Egypt reference four previous locations of the North Pole.

This paper presents the results of a study that finds 64 sites in Mexico and Central America are aligned to these same pole locations. Section 2 describes the data and methods used. Results are compared to those reported by González-García and Šprajc (2016). Section 3 presents two case studies that demonstrate the ability of our shifted pole model to explain the alignment of two important sites in Mexico: Tenochtitlan and Teotihuacan. By their alignment to previous locations of the North Pole over the past 100,000 years, a hypothesis first proposed by Charles Hapgood (1958), we propose that these sites were first established by a previous unknown civilization that inhabited this part of the world over that period of time. Predating the accepted historical record by many tens of thousands of years, Section 4 discusses our findings in the mythological context of the Mesoamerican legend of the Five Suns.

## 2. Data, Methods, and Results

Candidate locations in Mexico and Central America were downloaded from an online database listing the geographic coordinates of thousands of archaeological sites from across the world[1]. Aerial imagery over approximately 160 locations was examined using Google Earth and an app known as Sacred Directions[2] that was developed in part to support our research. About half of the sites were not visible in the imagery due to canopy cover, clouds, or poor lighting conditions, or were not of sufficient resolution to resolve structures of interest.

Define $(\lambda_A, \varphi_A)$ and $(\lambda_C, \varphi_C)$ to be the latitudes and longitudes of a site and a past pole in the current geographic reference frame. The azimuth angle of the past pole at the site is

$$A = \sin^{-1}\left[\frac{\sin a \sin B}{\sqrt{1-(\cos a \cos c + \sin a \sin c \cos B)^2}}\right]$$

[1] http://www.ancientlocations.net
[2] https://beforeatlantis.com/apps/

where

$$a = \frac{\pi}{2} - \lambda_C,$$
$$c = \frac{\pi}{2} - \lambda_A$$
$$B = \varphi_C - \varphi_A$$

We compared the sides of rectangular structures to the direction of the current pole and four past poles in Hudson Bay, the Norwegian Sea, Greenland, and the Bering Sea (Carlotto 2019a). The results are summarized in Table 1. Selected site alignments illustrated in Figure 2.

18 of the sites reference the current geographic pole including 4 alignments to major lunar standstills and 5 to solstices. The majority of the sites examined (31) are aligned in the direction of the Hudson Bay pole. Fewer sites are aligned to the Norwegian Sea pole (9) and the Greenland pole (9). Two sites are aligned to the Bering Sea pole. We also found 24 sites aligned in a direction a few degrees east of the Hudson Bay pole.

Figure 3a-d plots the north and east facing alignment directions of the four previous pole locations at a representative site in central Mexico. Figure 4 superimposes our site counts scaled to match those of González-García and Šprajc. It is evident that the relative frequencies of site alignments in directions of past poles are correlated with significant peaks in the histogram. The second peak in the histogram may be related to the second set of alignments noted in Table 1 east of the direction of the Hudson Bay pole.

## 3. Case Studies

Beginning around 500 CE waves of Nahuatl-speaking people began to migrate into the Valley of Mexico from the north. The last wave who called themselves the Mexica arrived on a marshy island in Lake Texcoco known as Tenochtitlan at a spot that, according to legend, had been pre-ordained by Huitzilopochli, the Aztec god of the Sun and war. There they built a pyramid with twin temples on the top – one dedicated to the rain god Tlaloc and the other to Huitzilopochli (Figure 5a).

By the time of the Spanish Conquest this structure, which is now known as Templo Mayor at the heart of modern-day Mexico City, had been expanded in a series of phases each time preserving the original design with later pyramids built over and around the original pyramid in a manner not unlike that of a Russian nesting doll (Figure 5b). Pyramids of similar design were built at Tenayuca, Acatitlan, Tlatelolco, and Texcoco.

Templo Mayor and the surrounding area in Mexico City are rotated south of east with respect to the cardinal directions. Scholars have suggested various reasons for this alignment related to important Aztec calendar dates, agricultural cycles, and horizon features such as mountain peaks. According to a Spanish friar who arrived in Mexico soon after the Conquest, the Aztec feast of Tlacaxipehualiztli “took place when the sun stood in the middle of [the Temple of] Huitzilopochtli, which was at the equinox, and because it was a little out of line, [King] Moctezuma wished to pull it down and set it right” (Aveni et al 1988). One explanation for why Templo Mayor is not aligned due east-west is that it had to

be rotated to compensate for the elevation of the sun by the time it had risen high enough to be seen between the two temples at the top of the pyramid (Figure 5c).

However, if this explanation were correct, as the structure was expanded, the rotation angle of the later phases should be greater than the rotation angle of earlier phases. According to measurements made by Šprajc (2000a) the east orientation of the smaller Phase II structure (7.7° south of east) is greater (not less) than the east orientation of later phases (5.6° south of east). In Mexico City, the azimuth angle of the Greenland pole is approximately 6.5° east of north. That Templo Mayor and the surrounding area in modern-day Mexico City are aligned in the same direction (Figure 5d) as are 7 other sites in Mexico suggests that the alignment to the Greenland pole may be a more plausible explanation.

It is thought that the ancient city of Teotihuacán, about 25 miles northeast of Tenochtitlan, was established before the Mexica migration. Like Tenochtitlan, Teotihuacán is also rotated, but a different angle, between 15 and 16° clockwise from the cardinal directions. Various reasons have been proposed for why the architectural plan of the city was designed in this way. One suggestion is that the site was intended to be a reflection of the surrounding landscape and so was aligned to face a nearby mountain peak, Cerro Gordo approximately 18 km to the east-southeast. Another possibility is that the city was aligned in the direction in the Pleiades (Aveni 1980) at the assumed date of construction. Šprajc (2000b) shows that this alignment also corresponds to the directions of sunrises and sunsets on two different sets of calendar dates 260 days apart.

The orientation of Teotihuacán along with many other sites in Mesoamerica is in the range 15° to 18° clockwise from the cardinal directions, which have become known as the "17° family of orientations" (Aveni 1980). The two main peaks in the histogram in Figure 1 are clearly related to this group of orientations, which is largely unexplained other than to say that an eastern skew was a standard architectural practice over a wide area in Mexico at that time. The shifted pole model accounts for the alignment of these sites and explains the reason for the skew.

Figure 6a is an overview of the alignment of Teotihuacan to the Hudson Bay pole. Possible solar and lunar alignments relative to the Hudson Bay pole south of the Pyramid of the Moon (that have yet to be analyzed in detail) are illustrated in Figure 6b.

## 4. The Legend of the Five Suns

According to an early Spanish chronicler Francisco López de Gómara (von Humboldt 1810):

> "The peoples of Culhua or Mexico believe, according to their hieroglyphic paintings, that before the sun that now shines upon them, four suns had already existed and had been extinguished, one after the other. These five suns constitute the ages in which humankind was wiped out by floods, earthquakes, an all-consuming blaze, and the effect of fierce storms."

We hypothesize that the current and four previous world ages described in the legend of the Five Suns correspond to the current and past four locations of the geographic pole, and the disasters that ended each age were the result of sudden displacements of the Earth's crust.

A post-Conquest manuscript known as the Codex Chimapopoca is often cited as a source for the legend of the Five Suns, which is represented in the Aztec Sun Stone (Figure 7). According to Lehman's translation of the codex (Lehman 1906), the durations of the four past Suns were 676 + 364 + 312 + 676 = 2028 years. This timeline corresponds to the Aztec's understanding of history that began when they left a place called Aztlan in 1073, which they believed was under the Fifth Sun. 2028 years earlier or 955 BCE would have been the start of the First Sun, which corresponds to the time of the Olmecs, the earliest known civilization in Mexico that is thought to have existed from 1200 to 400 BCE.

There are other versions of the legend in which the order and timing of the Suns is different. For example, in the Mayan version, each Sun is associated with a Great Cycle of 5125.25 years. The next to last Great Cycle began in 3114 BCE and ended in 2012.

Von Humboldt (1810) describes a mid-16th century account of the legend that can be traced back to Fernando de Alva Cortés Ixtlilxóchitl, who was a descendant of the rulers of the ancient city of Texcoco[3]. According to Ixtlilxóchitl, the First Sun was called Tlaltonatiuh, the epoch of the earth, or the "age of the giants." Von Humboldt associates this age with the earliest mythological periods across the world. We hypothesize that the First Sun corresponded to the period of time then the North Pole was in the Bering Sea.

The Second Sun was called Tletonatiuh, the age of fire. The Aztec god of fire, Xiuhteuctli, is associated with Tlaloc, the rain god, at Tenochtitlan[4]. As noted earlier one of the twin temples atop Templo Mayor was dedicated to Tlaloc. Templo Mayor and the surrounding area in Mexico City are aligned in the direction of the Greenland pole. We hypothesize that sites aligned to the Greenland pole were built in the age of the Second Sun.

The Third Sun was called Ehecatonatiuh, the age of the wind or air, which is often associated with Quetzalcoatl. The Pyramid of Kukulcan at Chichen Itza is aligned to the Norwegian Sea pole. Similarly, we hypothesize that sites aligned to the Norwegian Sea pole were built in the age of the Third Sun.

The Fourth Sun was the previous age called Atonatiuh that ended in a great flood. This age was presided over by the Aztec goddess of water, Chalchiuhtlicue. The statue of Chalchiuhtlicue displayed at the National Museum of Anthropology in Mexico City was found within the Temple of the Moon at Teotihuacan. We propose that Teotihuacan and other places that are aligned to the Hudson Bay pole were built in the age of the Fourth Sun.

## 5. Discussion

The tendency to seek out explanations for archaeological sites that are far older than established timelines is anathema to Western scientific thought. Yet the extraordinary hypothesis that these sites were first established by an earlier civilization who aligned the sites in the detection of the North Pole at the time of construction is supported by extraordinary evidence. If Hapgood's theory of crustal displacements and pole shifts is wrong what other reason can account for the alignment of the 64 sites in Mexico and

[3] It is interesting to note that Ixtlilxóchitl, who is thought of have been the original author of the Codex Chimapopoca, never expressed any knowledge of the manuscript (Bierhorst 1992).
[4] https://tenochtitlan.ace.fordham.edu/exhibits/show/huehueteotl-figure/huehueteotlxiuhtecuhtli

Central America discussed in this paper plus more than a hundred other sites discovered thus far in other parts of the world to the same four locations?

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**Table 1 Lists of sites examined with alignments to the current pole in the Arctic (AR) and former poles in Hudson Bay (HB), the Norwegian Sea (NS), Greenland (GR), and the Bering Sea (BS). The eHB alignment is discussed in the text.**

| Site | Latitude | Longitude | AR | HB | NS | GR | BS | eHB | Site | Latitude | Longitude | AR | HB | NS | GR | BS | eHB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acozac | 19.328553 | -98.892362 | M | | | | | | Muyil | 20.078828 | -87.611372 | | E | | | | |
| Becan | 18.518021 | -89.467764 | | E | | | | E | Oxkintoc | 20.560518 | -89.95391 | | E | | | | E |
| Bonampak | 16.703732 | -91.06477 | | m | | M | | | Palenque | 17.484531 | -92.046201 | | | E | | | |
| Calakmul | 18.106764 | -89.810442 | | E | | | | | Pomona | 17.484827 | -91.570255 | | E | | | | |
| Calixtlauaca | 19.331577 | -99.69359 | E | | | | | | San Andres | 13.800702 | -89.389288 | S | | | | | |
| Cantona | 19.552206 | -97.488024 | | E | | | | | Tenam Puente | 16.14172 | -92.106149 | M | | | | | |
| Caracol | 16.761902 | -89.11954 | | | | | | E | Tenochtitlan | 19.432751 | -99.133644 | | | | E | | |
| Chalcatzingo | 18.676703 | -98.771022 | | | | E | | | Teotenango | 19.108702 | -99.59783 | | E | | | | |
| Chiapa de Corzo | 16.702781 | -93.00406 | M | | | | | | Teotihuacan | 19.69291 | -98.846064 | | E | | | | |
| Chimalacatlan | 18.446236 | -99.105878 | | | | | E | | Texcoc (Los Melones) | 19.508957 | -98.881396 | | | | E | | |
| Chicanna | 18.506949 | -89.48619 | E | E | | | | | Texpoteco | 19.000668 | -99.101426 | | | E | | | |
| Chichen Itza | 20.683291 | -88.568758 | | | E | | | | Tikal | 17.221703 | -89.623819 | | E | | | | |
| Cholula | 19.056873 | -98.303248 | S | | | | | | Tonina | 16.90161 | -92.009639 | | | E | | | |
| Coba | 20.490197 | -87.73193 | | E | | | | E | Tula | 20.063699 | -99.340969 | | E | | | | |
| Comalcalco | 18.279313 | -93.201 | | E | | | | E | Tulum | 20.214753 | -87.429268 | | | E | | | |
| Copan | 14.838376 | -89.141759 | | E | | | | | Uaxactun2 | 17.391245 | -89.629368 | E | | | | | |
| Dainzu | 17.003622 | -96.557102 | | E | | | | | Ujuxte | 14.539021 | -92.035707 | | | | | | E |
| Dzibanche | 18.638502 | -88.759124 | | | E | | | | Uxmal | 20.361133 | -89.770627 | | E | | | | |
| Dzibilnocac | 19.578138 | -89.594803 | | | | | | E | Xcambo | 21.313568 | -89.353916 | | | | | | E |
| Edzna | 19.596968 | -90.229784 | | | | | | E | Xochicalco | 18.803963 | -99.296278 | | E | | | | |
| Ek Balam | 20.891478 | -88.136064 | E | E | | | | E | Xpuhil | 18.510688 | -89.406435 | | E | | | | |
| El Rey | 21.061587 | -86.781386 | | | | | | E | Yagul | 16.958366 | -96.45016 | S | | | | | |
| El Tabasqueno | 19.500565 | -89.784126 | | | | | | E | Yaxha | 17.07589 | -89.402417 | | E | | | | |
| Guiengola | 16.386052 | -95.323421 | E | | | | | | Yaxha4 | 17.070676 | -89.399819 | | | | | | E |
| Hochob | 19.408252 | -89.771231 | | | | E | | | Zempoala | 19.447205 | -96.404163 | E | | | | | |
| Huexotla | 19.476184 | -98.872534 | | E | | | | | Pyramid at Acatitlan | 19.552588 | -99.173392 | | | E | | | |
| Huizachtecatl | 19.343882 | -99.089928 | | | | E | | | Pyramid at Malinalco | 18.953174 | -99.503102 | | | | E | | |
| Itzamkanac | 18.121148 | -90.836967 | | | | | | E | Temple at Teopanzolco | 18.930412 | -99.22199 | E | | | | | |
| Izamal | 20.936828 | -89.016711 | | | | | | E | Termple at Tenayuca | 19.532151 | -99.168662 | | E | | | | |
| Izapa | 14.923398 | -92.179993 | S | | | | | | El Puente | 15.110176 | -88.791622 | | E | | | | |
| Jaina | 20.208331 | -90.486164 | | | E | | | | Great Pyramid at Cempoalla | 19.447725 | -96.403921 | E | | | | | |
| Kabah | 20.248435 | -89.647464 | | | | | | E | Northern pyramid at Acanceh | 20.813568 | -89.452019 | | | | | | E |
| Kohunlich | 18.419343 | -88.791103 | | E | | | | E | Palace at Aké | 20.947708 | -89.299719 | | | | | | E |
| La Campana | 19.268135 | -103.725676 | S | | | | | | Palace at Altun Ha | 17.763612 | -88.347385 | | E | | | | |
| La Reforma | 17.768895 | -91.297796 | | E | | | | E | Palace of the Stuccos at Acanc | 20.810651 | -89.451997 | | | | | | E |
| Labna | 20.171445 | -89.578635 | | E | | | | E | Southern pyramid at Acanceh | 20.813311 | -89.452448 | | | | | | E |
| Lagartero | 15.827844 | -91.883811 | M | | | | | | Temple at Aké | 20.946972 | -89.301669 | | | | E | | |
| Mayapan | 20.629642 | -89.460665 | E | | | | | | Temple at Aké2 | 20.947081 | -89.30064 | | | | E | | |
| Mitla | 16.926815 | -96.359506 | | E | | | | | Temple at Chinkultic | 16.128926 | -91.785087 | | | | | E | |
| Mixco Viejo | 14.872219 | -90.664236 | | | | | | E | Temple at Tazumal | 13.979709 | -89.674452 | | | E | | | |
| Mixcoac | 19.386284 | -99.189854 | | E | | | | | Temple of the Masonry Altars | 17.763913 | -88.346885 | | E | | | | |

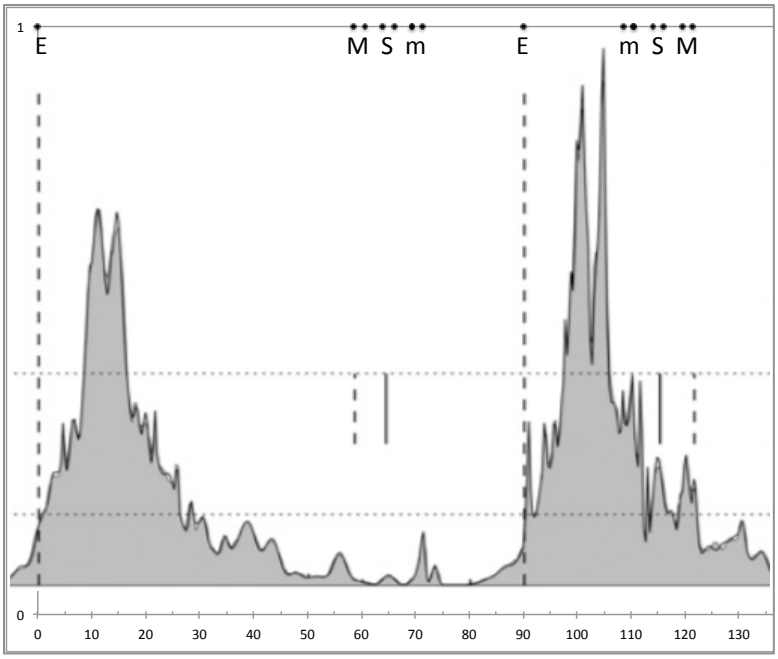



**Figure 1 Histogram of site azimuth angles with key directions indicated: equinox (E), solstice (S), major (M) and minor (m) lunar standstills. Adapted from González-García and Šprajc (2016).**

a) Temple of the Feathered Serpent at Xochicalco is aligned to the Hudson Bay pole

b) The pyramid of Chalcatzingo is aligned to the Greenland pole

c) Ek Balam. Acropolis to the north is aligned to the current pole. Oval palace and surrounding structures to the south are aligned toward the Hudson Bay pole.

d) Chichen Itza. The Temple of Kukulcan and other structures are aligned to the Norwegian Sea pole.

**Figure 2 Examples of site alignment to previous poles computed using Sacred Directions app.**

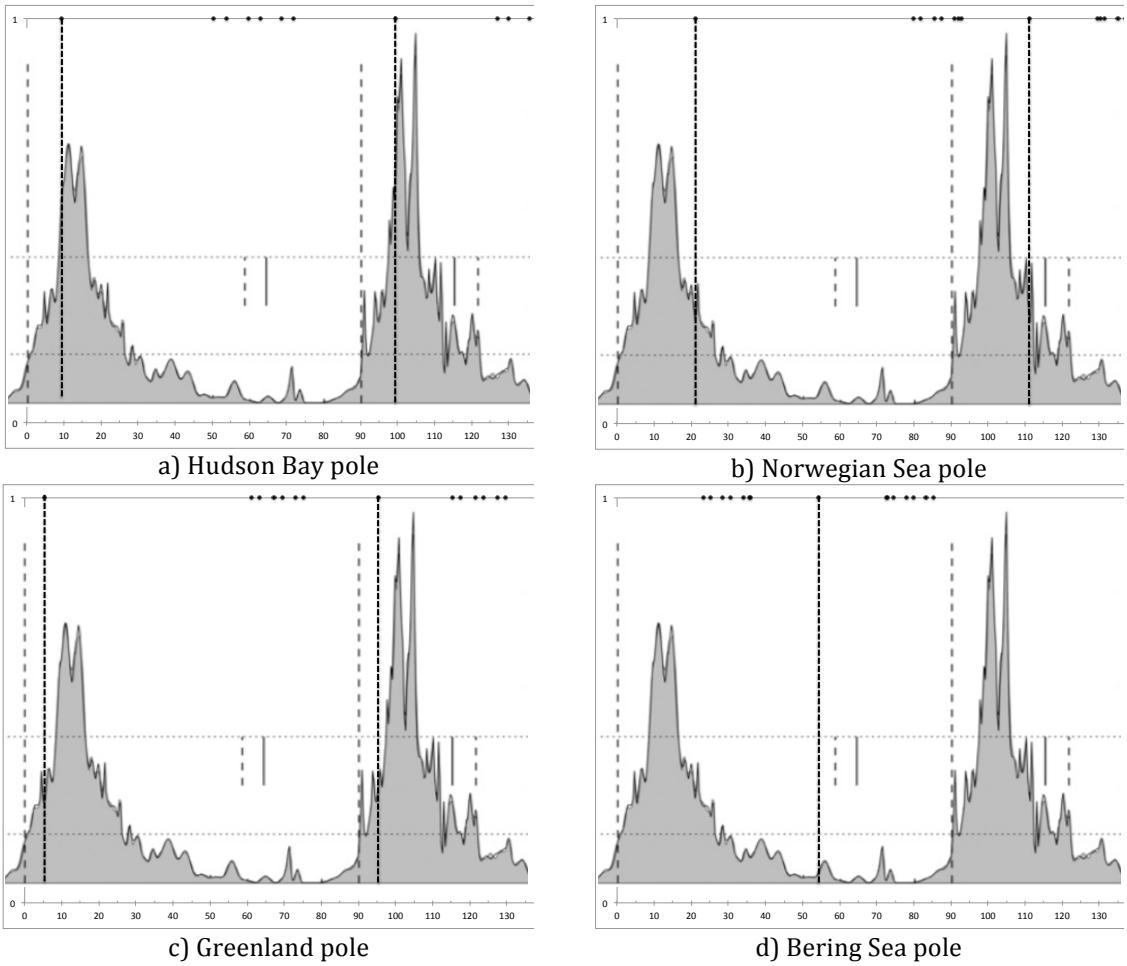



**Figure 3 North and east alignment azimuths of previous poles in Mayan lowland study area.**

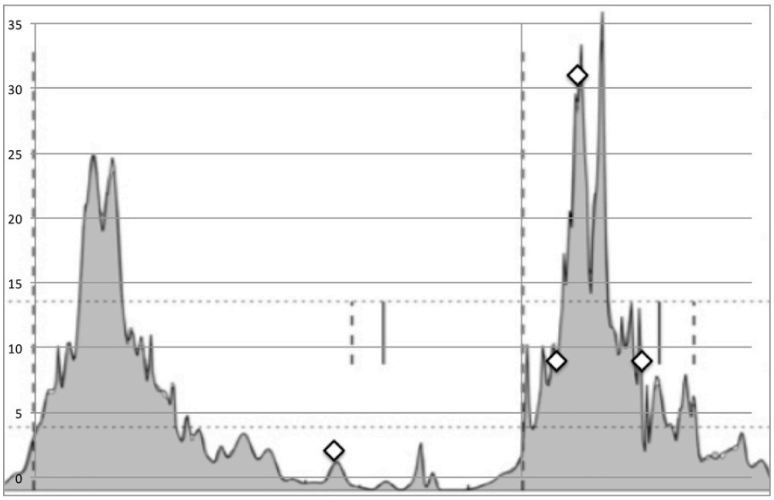
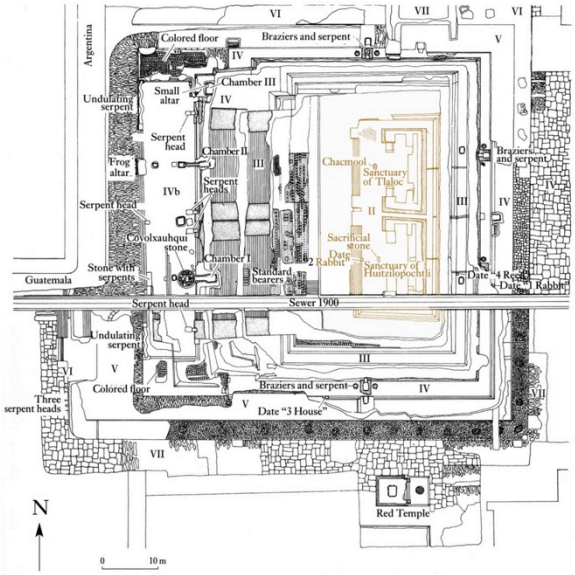
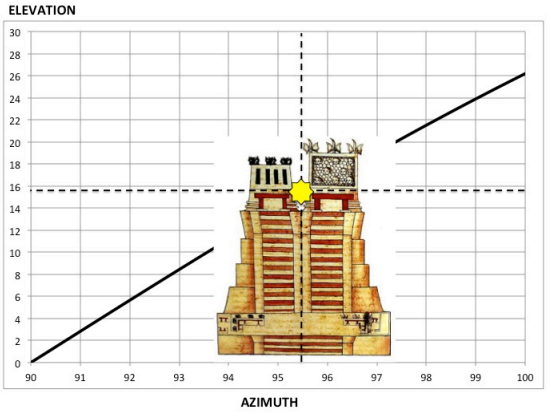



**Figure 4 Previous pole alignment counts superimposed on site orientation histogram.**

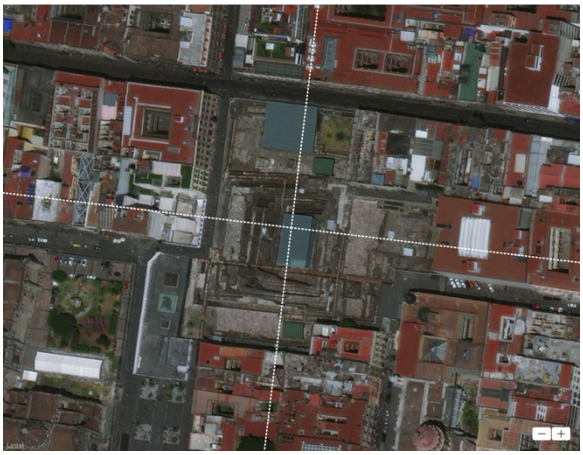
a) The original design of Templo Mayor is evident in the excavated remains of the second pyramid (Phase II) that lies under a protected roof at the site. The two structures at the top were the temples dedicated to Tlaloc (left) and Huitzilopochli (right).




b) The earliest surviving ( Phase II) structure is highlighted in this plan view of Templo Mayor.




c) The solar path at Templo Mayor on the equinox. The sun rises due east at the horizon. For a structure viewed from the west at sunrise on the equinox, the sun rises above the structure south of east. To make the sun appear to rise directly between the two temples the structure must be rotated clockwise and viewed from a position slightly north of west. As the height of the structure increases the sun rises further to the south. Thus as Templo Mayor was expanded it should have been rotated clockwise by increasing amounts.



d) The orientation of Templo Mayor (center) and surrounding region in Mexico City is rotated approximately 6.5° south of east in the direction of the Greenland pole.

**Figure 5 Analysis of alignments at Tenochtitlan**

a) Alignment of main axis of Teotihuacan to the Hudson Bay pole

b) Possible solar and lunar alignments below the Pyramid of the Moon

**Figure 6 Alignments at Teotihuacan relative to the Hudson Bay pole**

**Figure 7 Aztec Sun Stone showing the five Suns or gods of Aztec mythology. Counter-clockwise from the top right are glyphs representing Tezcatlipoca, Quetzalcoatl, Tlaloc, and Chalchiuhtlicue. The current Sun Huitzilopochtli is in the center.**